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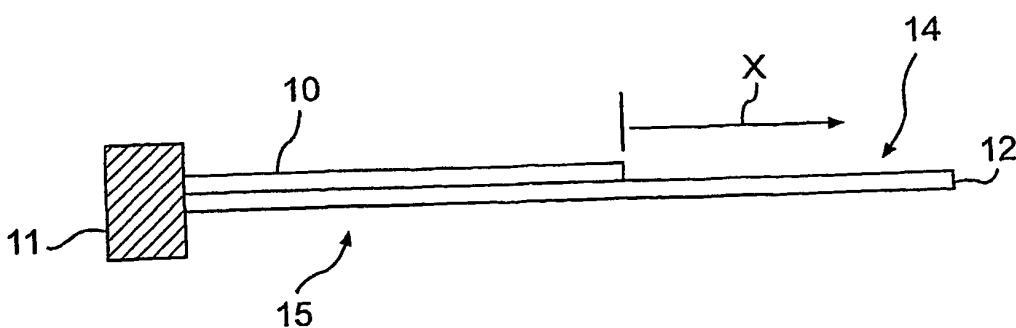
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(57) Abstract: A piezoelectric cantilever with a non-piezoelectric, or piezoelectric tip useful as mass and viscosity sensors. The change in the cantilever mass can be accurately quantified by monitoring a resonance frequency shift of the cantilever. For bio-detection, antibodies or other specific receptors of target antigens may be immobilized on the cantilever surface, preferably on the non-piezoelectric tip. For chemical detection, high surface-area selective absorbent materials are coated on the cantilever tip. Binding of the target antigens or analytes to the cantilever surface increases the cantilever mass. Detection of target antigens or analytes is achieved by monitoring the cantilever's resonance frequency and determining the resonance frequency shift that is due to the mass of the adsorbed target antigens on the cantilever surface. The use of a piezoelectric unimorph cantilever allows both electrical actuation and electrical sensing. Incorporating a non-piezoelectric tip enhances the sensitivity of the sensor. In addition, the piezoelectric cantilever can withstand damping in highly viscous liquids and can be used as a viscosity sensor in wide viscosity range.